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B1 75. (Amended) The device in claim 74, further comprising another  
conductive layer formed on the tungsten nitride layer.

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#### REMARKS

Claims 73-75 are currently pending in the present patent application. In the Office Action mailed January 11, 2002, the Examiner rejected claims 73-75 under 35 U.S.C. § 112, second paragraph, for failing to particularly point out and distinctly claim applicant's invention. Claims 73-75 were also rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,281,542 to Wu ("Wu").

Claims 73-75 have been amended and any deficiencies under Section 112 eliminated. With regard to the rejection of the claims over Wu, in order to help the Examiner appreciate certain distinctions between the pending claims and the subject matter of the applied reference, the disclosed embodiment of the invention will now be discussed in comparison to the applied reference. Specific distinctions between the pending claims and the applied reference will be discussed after the discussion of the disclosed embodiment and the applied reference. This discussion of the differences between the disclosed embodiment and applied reference does not define the scope or interpretation of any of the claims.

Applicant's invention exposes a conductive layer to an oxygen-inhibiting plasma or other gas, including nitrogen free gases, prior to the formation of the another layer or layers on the conductive layer to substantially reduce the association of oxygen with the conductive layer during formation of the other layer or layers. By reducing the amount of oxygen associated with the conductive layer, the electrical characteristics of a semiconductor device including the conductive layer are improved, as will be discussed in more detail below with reference to the disclosed embodiments of the invention. One embodiment of the present invention is discussed with reference to Figures 7-10 in which an interposing layer 52 such as a tungsten nitride layer 52 is formed between a conductive plug 46 formed in a via 44 and a conductive line material 48 formed in a trench or container 50. The tungsten nitride layer 52 enhances the electrical contact between the line material 48 and the plug 46, promotes adhesion of the line material within the

container 50, and prevents or slows the diffusion of materials across the tungsten nitride layer boundary, or serves some other purpose. The tungsten nitride layer 52 may associate with oxygen after it is formed and subsequent thermal processes may result in the formation of an oxide layer 54 formed between the tungsten nitride layer 52 and the line material 48 as shown in Figure 8. Because the oxide layer 54 is an insulator, this layer will adversely affect the electrical connection between the line material 48 and the plug 46.

By exposing the tungsten nitride layer 52 to an oxygen-inhibiting agent or a reducing atmosphere prior to formation of the line material 48, the thickness of the oxide layer 54 is reduced to a thickness of less than 10 angstroms or entirely eliminated as illustrated respectively in Figures 9 and 10. As described in the specification, the tungsten nitride layer 52 or other conductive layer may be treated with gases such as diborane  $B_2H_6$ ,  $PH_3$ ,  $CH_3SiH_3$ ,  $(CH_3)_3Si-Si(CH_3)_3$ , HMDS,  $CF_4$ ,  $CHF_3$ ,  $HCL$ ,  $BCl_3$ , and silane  $SiH_4$ , and any combinations of these gases, as described on page 7, lines 25-30, page 8, lines 1-16, and page 9, lines 1-12. Even if the tungsten nitride layer 52 is exposed to oxygen, the layer may thereafter be exposed to a reducing atmosphere, such as silane gas  $SiH_4$ , prior to formation of the line material 48 to thereby reduce the oxygen content of the tungsten nitride layer 52 and reduce the thickness of or eliminate any silicon dioxide layer 54 thereafter formed. A reducing atmosphere removes oxygen from a material, which is said to have been reduced, in contrast to oxidation in which a material associates with oxygen, as understood by those skilled in the art.

The Wu patent discloses a capacitor structure that increases the effective area of electrodes of the capacitor, which increases the capacitor's capacitance. The capacitor includes a first conductive layer 113a and second conductive layer 130b as shown in Figure 9 that together form a bottom plate of the capacitor and a third conductive layer 140 as shown in Figure 11 forms a top plate of the capacitor. No disclosure nor suggestion is made in Wu of treating any of the conductive layers 113a, 130b, or 140 to reduce an ability of the layer with oxygen. Moreover, Wu does not disclose or suggest exposing any of the conductive layers 113a, 130b, or 140 to one or a combination of diborane, phosphine, methylsilane, hexamethyldisilane, hexamethyldisilazane,  $HCL$ , and boron trichloride.

Returning now to the claim rejections in view of Wu, amended claim 73 recites an in-process device including a substrate and a conductive layer over the substrate. The

conductive layer is exposed to a selection consisting of diborane, phosphine, methylsilane, hexamethyldisilane, hexamethyldisilazane, HCL, boron trichloride, and combinations thereof. This exposure reduces an ability of the conductive layer to associate with oxygen. Wu neither discloses nor suggests exposing a conductive layer to the recited selection of materials to reduce the ability of the layer to associate with oxygen. The combination of elements recited in claim 73 is therefore allowable. Dependent claims 74 and 75 are allowable for the same reasons as the independent claims, and because of the additional limitations added by these claims.

All pending claims are in condition for allowance, and favorable consideration and a Notice of Allowance are respectfully requested. The Examiner is requested to contact the undersigned at the number listed below for a telephone interview if, upon consideration of this amendment, the Examiner determines any pending claims are not in condition for allowance.

Note that a Revocation and Substitute Power of Attorney has previously been submitted in this application on December 19, 2001. Please direct all future correspondence to the new attorney of record (the undersigned) indicated in the Revocation and Substitute Power of Attorney.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made".

Respectfully submitted,  
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PFR:asw

Enclosures:

Postcard

Fee Transmittal Sheet (+ copy)

Copy of Previously Submitted Revocation and Substitute Power of Attorney

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

**In the Claims:**

Claims 73-75 have been amended as follows:

73. (Amended) An in-process device, comprising:  
a substrate; and  
a conductive layer over [said] the substrate, the conductive layer  
being exposed to a selection consisting of diborane, phosphine, methylsilane,  
hexamethyldisilane, hexamethyldisilazane, HCL, boron trichloride, and combinations thereof to  
reduce an ability of the conductive layer to associate with oxygen [and having a surface stuffed  
with a non-oxygen material].

74. (Amended) The in-process device of claim 73, wherein the conductive  
layer comprises tungsten nitride [said surface is a nitrogen-stuffed surface].

75. (Amended) The device in claim 74, further comprising another  
conductive layer formed on the tungsten nitride layer [wherein said surface is contacting an  
oxygen molecule].